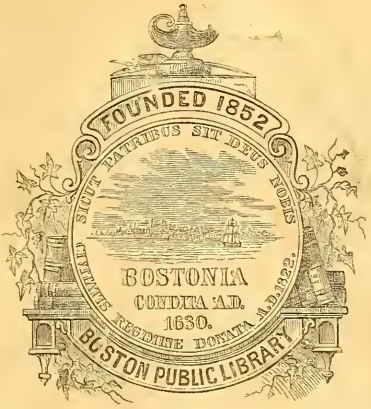

PAMPHLETS.

Agriculture,
Essays.

Memoranda.

From the Fifth Report of the Vermont Board of Agriculture.

ON SOME OF THE

INJURIOUS INSECTS

OF VERMONT.

By GEO. H. PERKINS, Ph. D.,
Professor of Zoology in the University of Vermont.

MONTPELIER:
J. & J. M. Poland, Steam Book and Job Printers.
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ON SOME OF THE INJURIOUS INSECTS OF VERMONT.

BY GEORGE H. PERKINS, PH. D.,

Professor of Zoology in the University of Vermont and State Agricultural College.

In articles on injurious insects in the Reports of the Board of Agriculture for 1876 and 1877 I have spoken of certain general means of prevention, of the necessity of united action, of constant action against our insect foes, and of the advantage of knowing what species of insects prey upon others that are injurious, that we may spare our friends as well as destroy our foes. I have also alluded to the very great damage which the crops of the United States annually suffer on account of the depredations of insects—a damage so vast in amount that were the data upon which estimates are based not collected with great skill and care we should find it difficult to believe it possible. But after all, I suspect that the greatest injury is that which is little noticed: the continual mischief which every crop suffers; not very much, perhaps, here or there, but a little everywhere; and if all these littles could be brought together the amount would be startling. When any particular insect (as the potato beetle) commits great ravages, the attention of every one is directed to the source of so great an evil, and great ingenuity is manifested in devising remedies, but meanwhile, comparatively unnoticed, hosts of other insects are biting, eating, boring, and destroying everything that the farmer tries to raise. The first step towards remedying (so far as it can be remedied) this evil is to become acquainted with the insects, and their habits, that are doing all this mischief; and the more thoroughly we can do this the farther are we towards the object we seek. Then, having learned what the insect is, what it does, and how it lives, we are ready to devise remedies which shall at least promise good results and shall not, as has time and again been done, propose remedies whose chief characteristic is their absurdity. Hundreds of dollars have been expended in some of our cities in putting bands of various sorts about trees whose foliage was being destroyed by some insect whose habits were assumed to be like those of the canker worm because its injuries were of a similar nature, when an investigation of the insects themselves would have shown that the females, instead of being wingless like those of the canker worm, were abundantly able and willing to fly over what was to them no barrier. At a meeting which was held about a year ago in London, a paper was read upon the subject which we are discussing, and from an abstract of this paper pub-

lished in "Nature" I wish to quote a few sentences that seem to me worthy of consideration. The object of the meeting was to consider "Insects injurious to agriculture and methods of stamping them out."

The paper, in considering remedies, mentioned as "The first, the simplest, the most powerful, and the most efficient, county or district rotation of cropping. Farmers know well enough the advantage of a rotation of cropping (or its equivalent) on their own farms. By long continued growth of the same crop on the same land the soil becomes exhausted of some of the elements necessary for the proper development of that kind of crop, and a change of crop brings other elements into use. Exactly the converse of this takes place with regard to certain insects. The great majority of vegetable-feeding insects do not feed on all kinds of plants indiscriminately; most of them are restricted to one kind of plant, and if, by cultivation of that plant, its numbers are enormously increased, so will naturally be the number of insects that feed upon it; while if we should cease to grow that plant the number of insects would correspondingly diminish. Thus, for instance, if a district is almost entirely in pasture there will be very few wheat-feeding insects in it, but if it is turned into a wheat country there will be myriads. If these numbers reach such a pitch as to deteriorate the crops the remedy is plain. Change the rotation and grow some other crop instead of wheat. Most of the wheat insects are only annuals. If they could be banished for one year they would be banished entirely, or until reintroduced." And then the author speaks of the need of some central authority who could secure this change of crops when needed, over a wide extent of country, for, of course, it would ordinarily be of no use whatever for a few only to change, fields adjoining would soon supply all lacking bugs, so soon as the crops suitable for food were raised. The usefulness of birds as insect destroyers I have more than once alluded to, and I would most earnestly urge all agriculturists to study carefully and thoroughly the habits of such birds as may live on their farms, and I am very sure that the more they know of them the more they will be convinced of their great value. And there is another friend of whom I wish to say a word and that is the toad. This animal does not occur in sufficient numbers to be very valuable on the farm, but that is the only reason it is not useful, and in the garden it is of great value. Toads feed entirely upon worms and insects, and a great many of them do they destroy in a summer, eating every sort of insect, even taking twenty or thirty black squash bugs at a sitting. I have recently seen it stated that toads are sent from the continent of Europe to England, and are bought by the gardeners to be placed in their vegetable and flower patches; and this is wise, for certainly the more toads there are in a garden the better, so far as destruction of insects is concerned.

The present season being a very early one is favorable to the increase of many kinds of insects, and many are unusually abundant. Very large numbers of potato beetles (*Doryphora decemlineata*) were brought to the surface in plowing in many parts of the State, and so soon as the potatoes were out of the ground they began their ravages; but diligent hand-picking has been successful, and from various parts of the State I hear that there is little trouble in keeping the pest in

check. Early in June a frost cut down the potato tops in many places, and this occurring just as the beetles were laying their eggs will help to keep them from increasing. The means of keeping this insect in check are so well known, as are also its habits, that I do not anticipate any serious damage from it during the coming season. As it increases its range it is met by new enemies, and now a goodly array of foes of various kinds assist in overcoming it. The most common and important of its insect enemies are several species of the common rose beetles, or "lady birds," quite a number of black or dark colored bugs resembling, though varying in size, the common black squash bug, several large beetles, several of the wasps, and a number of other insects.

But the most effective parasite thus far is a fly very much like a common house fly "both in color and size * * * * but is readily distinguished from the latter by its extremely brilliant silver-white face." (Riley.) Some of the parasites of this beetle devour the eggs, but others and most of them either devour the larva or lay their eggs upon it, which hatch, and the young feed upon their host before it reaches maturity; and a very few attack the mature beetles.

As much has been said in various published accounts of this beetle, of its food, most writers affirming that it feeds only upon the potato and can exist only where that is found, it is interesting to note that, although there can be no question as to its main food, it will nevertheless live and thrive, at least for a time, upon the egg plant, tomato, nightshade, and some other allied plants, and it has also been found feeding upon the common thistle, which it sometimes eats greedily, pigweed, smartweed, red currant, thoroughwort, and quite a number of other plants; but it seems certain that it is not likely to increase so rapidly when feeding upon any plant as the potato.

As, in the various papers which I have written, I have often referred to the aid which comes from parasitic insects, I have thought that, perhaps, a figure of a larva bearing eggs of its parasite might be of assistance to a full understanding of this most important subject, and the accompanying engraving, fig. 1, shows a larva of one of the grape-vine moths, bearing on its back eggs of an ichneumon fly, which is shown in fig. 2 (upper figure natural size, lower enlarged). These figures are given only as examples of a great variety of forms, still it is always best, when a caterpillar is seen bearing such appendages as those shown in fig. 1, to let it take care of itself instead of destroying it, for it is certain that the parasites will effectually prevent it from doing any harm, and will, if allowed to develop, destroy many others of the same kind.

Fig. 1.

Larva with eggs of Parasite.

Fig. 2.

Ichneumon Fly.

Among the most valuable and efficient allies which the farmer has in his warfare against injurious insects are the minute flies like that shown in fig. 2. In more than one instance very injurious insects have been kept in check and, perhaps, almost annihilated, by ichneumon flies, or some such parasite.

Through the liberality of the Board of Agriculture, which made an

appropriation from its funds for the purpose, I am able this year to present illustrations of most of the more important insects which are mentioned in the following pages. These illustrations were copied from Prof. Riley's "Reports" as Entomologist of Missouri; Prof. Packard's *Guide to the Study of Insects*; Dr. Harris' *Insects Injurious to Vegetation;* and are all very accurate. In some cases the engraving gives an enlarged view of the insect figured. When this is the case a fine line at the side indicates its natural length. In determining what species of insects should be treated this year I have been guided mainly by the inquiries which have come to me during the year, selecting from the many forms of injurious insects that are found in our gardens, fields, and forests, those concerning which most frequent inquiries have been made.

For a general account of the classification of insects, etc., the reader is referred to last year's report. In the following descriptions the division of the body of the insect into the three parts—head, thorax and abdomen—will be readily understood by any one who will examine the form of any insect and notice the natural division of the body into those three parts.

In the proceedings of the Vermont Dairymen's Association of last year a paper on "Internal Parasites" was published. As a partial appendix to that paper I wish to say a few words regarding a few external parasites, treating the subject much more briefly than I should, were it not for the publication of a very excellent paper on this subject by Dr. H. A. Cutting in the Second Report of the Board of Agriculture. It is not my intention to repeat what is there given, but to add some further facts, beginning with the

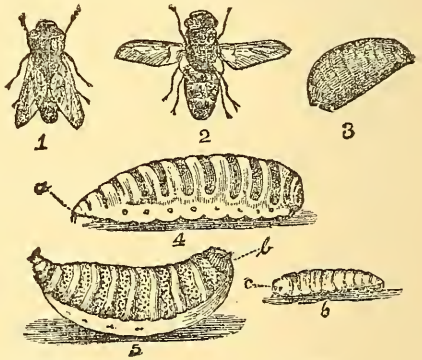
BOT FLY OF THE SHEEP.

ÆSTRUS OVIS. (Lam.)

There are several parasites that infest sheep, but this is the most troublesome of the external, and but one or two of the internal are able to inflict as serious injury. In the larva state it causes what is known as "grub in the head," "blind staggers," etc. It has been well known for many centuries in all sheep-raising countries.

The perfect insect (fig. 3, 1 and 2) is not very unlike the common house fly in general appearance, though larger. It is a brownish or ashen color with black lines on the thorax and black spots on the abdomen. On the under side the head is white, and the abdomen bears a dark spot on the middle of each ring, and it has also straw-colored and white markings. The eyes are purple, and on the top of the head are three little eyelets, or ocelli. The mouth parts are very rudimentary, and the insect

Fig. 3.



ÆSTRUS OVIS. (Lam.) 1—2, Adult Insect. 3, pupa; 4—5, larvæ. 6, young larva.

probably takes no food in the perfect state, its only function then being to reproduce its kind, and its life is very short. The fly is rather more than half an inch in length and nearly an inch across the expanded wings. It was formerly supposed that the eggs were deposited by the females in the nostrils of the sheep, and this is stated as a fact in most works; but, according to Riley and others, the living grubs, or larvæ, not the eggs, are placed in the nose of the sheep. The flies are most abundant during June and July, though they sometimes appear later. The larva (figs. 3, 4 and 5) when first produced is of a whitish color with two brown spots on the last joint. It is cylindrical and taper from the last segment forward. The last segment which bears the brown spots, which mark openings through which the worm breathes, can be withdrawn into that just before it. As the grub approaches its full growth, its color becomes darker and when mature it is dark brownish on the last segments, but grows lighter towards the head. This is furnished with two small hooks, and above them are two tubercles. The lower side is flat and, when the last joint is drawn in, the posterior end looks as if cut squarely off. When full grown the grub is about an inch long. The female is very prolific, and may produce two hundred or even three hundred young. As soon as the larva is deposited in the nostril of the sheep it begins to creep upwards, irritating the delicate lining membrane of the nose as it ascends. In time it reaches the cavities in the skull just above the eyes and to the mucous lining of these places many grubs may be attached by means of the hooks above mentioned. Here they may remain, feeding upon the secretions, or even the membrane itself. Much more rarely the larvæ penetrate the brain, working along the olfactory nerve. The larvæ remain in the head of the sheep eight or ten months and, if there are many, they cause serious inflammation, sickness, and perhaps death. Finally they loose their hold and drop from the nose to the ground, into which they burrow for a short distance. They then soon contract to about one half of their previous size and become covered with a black smooth case (fig. 3). In this condition they remain from forty to sixty days, at the end of which time they push off one end of the pupa case and come out perfect flies and are soon ready to deposit their young. The sheep recognize the fly as an enemy and seek to escape from it if it comes near them. The usual movements of the fly are rather sluggish, but when about to deposit a larva they are very quick and very persevering, if driven away returning again and again, so that it is very difficult to prevent her from accomplishing her purpose. If only a few of the larvæ are present their effects may not be noticeable, though they must always be bad, but if many are present, the sheep loses its appetite, coughs, sneezes, has discharges from its nose, which may be so great as to cause difficulty in breathing, the animal may not be able to stand erect, tosses its head, has fits of rushing wildly about, its gums, back of mouth, and inside of the nose are inflamed, and may have other symptoms of severe disorder. If the sheep has strength enough to withstand the evil effects of their presence until the larvæ have matured and leave the head it will gradually recover, but will not for a long time, if badly affected, be as vigorous as before, if ever.

REMEDIES. As would naturally be expected of a trouble so long known, this has many remedies, all, of course, intended to dislodge the grub and cause its expulsion.

As there are five or six weeks in every season during which the larvæ, having left the sheep, are in the ground undergoing transformation, the sheep might at this time be removed to a distant pasture so that they would be out of the way when the flies came from the chrysalids. This has been strongly recommended as a preventive of the trouble, but it would, probably, be only partly efficacious in many cases. After the larvæ have reached the cavities connected with the nose it would seem quite impossible to administer any substance which would dislodge them that would not injure the sheep, but, if they can be taken in hand before they have ascended far into the nostrils, much may be done. Inhalations of carbonic acid vapor would undoubtedly be useful, such as were recommended for strongylus in the paper on "Internal Parasites" in the last Report.

A good method of preparing this is to obtain the carbolic acid in crystals, and put a couple of teaspoonfuls of these into a pint of water, or, if there is no great inflammation, the solution may be made much stronger, and, having the animal in readiness, put one or two heated stones or bits of iron into the solution and cause the sheep to inhale the vapor arising, taking care not to burn the lining of the nose by too hot vapor.

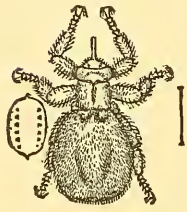
A feather dipped in oil of turpentine, or in a weak solution of carbolic acid, or creosote, and run gently up the nostril and turned around several times has been recommended. If the larvæ have not gone far, any substance that causes vigorous sneezing, as air-slaked lime, might affect their removal. The old and well known remedies of tarring the noses of the sheep (and only the end of the nose as far up as the openings of the nostrils needs tarring), and that of providing a plenty of loose earth into which the sheep can readily thrust their noses, sometimes prove quite sufficient and are certainly simplest of all. Whatever remedy is used must be repeated from time to time during June, July and August, while the fly is about.

Another parasite found on sheep is what is known as

THE SHEEP TICK.

MELOPHAGUS OVINUS. (Linn.)

Fig. 4.



MELOPHAGUS OVINUS.

This insect, though belonging to the same group as the flies — the *Diptera* — is very unlike them in appearance. It is a hairy insect, never furnished with wings, having the form shown in fig. 4. Its color is brown. It is about half an inch long, with a very broad head, which is furnished with a proboscis, which is thrust into the skin of the animal it infests. This instrument is made up of two long, narrow rods or plates, below which are three very slender rods which can at will be drawn into a small opening. These pierce the skin and the blood is drawn up into the mouth. Two of the three piercing organs are more slender than the third, or lower, which is grooved along its upper side, and in this groove the other two may be laid.

The thorax is a little wider than long, but narrower than the head. The abdomen is very large and more or less globular, flattened somewhat above. The young are not hatched from eggs, but the pupa is produced in a sort of case, as seen in the oval body on the left of the insect in fig. 4. This case contains but a single insect. Although apparently not a prolific insect, the tick sometimes becomes very abundant and troublesome, injuring especially young or sickly animals.

Remedies. Snuff, tobacco tea, sulphur water, dilute petroleum, naptha, benzine, carbolic acid, all have been recommended and have all proved useful. Suds made from whale oil or carbolic soap is good. I think carbolic acid is especially good for such a purpose, as its peculiar, and to all insects very disagreeable, odor is very persistent. I have known it to be perceptible some months after its application, whenever the animal was exposed to a rain and thus the skin and its covering dampened. It is well to remember that in buying carbolic acid it is always best to buy it in the form of crystals. It can be bought at most drug stores, put up in pound bottles, for from a dollar to a dollar and a half a bottle, which is much less than its usual price by the ounce. If the bottle be immersed in warm water the mass readily becomes liquid, and the addition of a little warm water prevents it from again solidifying, and a pound thus prepared will last a long time, unless it is necessary to use it for a large number of animals. Used in this way the strength is more certain. One part of this acid to from twenty to forty of water makes a good wash; the strength, of course, must vary with the age and vigor of the animal upon which it is to be used.

The cattle tick (*Ixodes bovis*) is a very different animal, and belongs to the *Arachnida*, or the group containing spiders, mites, etc. It has eight instead of six legs, and the body is not divided into three, but only two parts. It is oval in outline, flattened above, and of a reddish brown color. The insect which causes mange in horses is of similar nature. Mange in animals is essentially the same in its origin and effects as itch in man, the trouble being caused by the presence of minute mites which burrow in the skin. The mange insect of the horse, *Psoroptes equi*, Ger., is large enough to be seen with the naked eye, and it sometimes occurs in immense numbers. It is a whitish mite, with reddish or horn-colored legs, which are sparsely covered with long hairs. The body is soft, oval, flattened. The horse tick on the other hand is a very different insect; this is a true fly, like the bot fly. It does not spend all its time on the horse, but flies about, coming to a horse now and then and inflicting a painful bite, which greatly irritates the horse and may render it unmanageable. It is allied to the sheep tick, and like it produces its young alive. When it has once settled upon a horse, usually the under side, it remains fast for some time.

As a very excellent remedy for lice, ticks, mange mites, and all such pests as adhere to the skin or hair of animals, I quote the following from Prof. Verrill's paper in the Fourth Report of the Connecticut Board of Agriculture. He says: "But perhaps one of the best and simplest as well as safest washes to destroy * * * * * external parasites of man and animals is a solution of sulphuret of potassium in water, two to four ounces to the gallon of water, varying the

strength according to the age and tenderness of the skin of the animal, for the solution will contain some free potash, which if too strong, might irritate a delicate skin. There is otherwise no danger from its use, though its odor, like sulphuretted hydrogen, is disagreeable, and should be used therefore where there is plenty of ventilation. This is an exceedingly valuable remedy * * * The sulphuret of potassium comes in the form of grayish or greenish lumps put up in tight bottles. It is used in photography, and can usually be bought at the principal drug stores. An equally useful preparation, having the same properties, may easily be made by taking fresh quicklime, slacking it gradually with water and forming a milky solution by the addition of more water. Into this put as much flowers of sulphur as will dissolve by boiling for some time. This will produce a deep yellow solution like that of the sulphuret of potassium. Sulphur may also be boiled in potash lye to produce a similar preparation, and to this, while boiling, tobacco is sometimes added, but the sulphur is no doubt sufficient for all practical purposes."

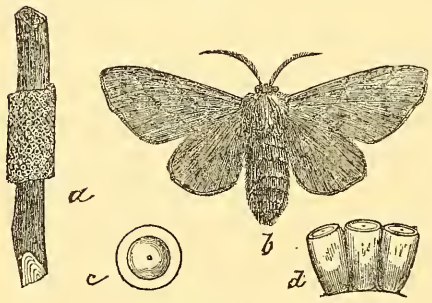
Whatever wash is used will need to be repeated once, or perhaps more than once, at intervals of about two weeks, to destroy such insects as may have hatched since the last was applied, for any wash that does not injure the animal fails to destroy all the eggs of insects which may be present. For a full account of the Bot fly of cattle and that of the horse, the reader is referred to Dr. Cutting's paper, mentioned above.

At a meeting of the Board of Agriculture at South Hero last fall, many questions were asked concerning what is there known as the "forest worm," which sometimes fell upon an orchard in great numbers and, perhaps, in twenty-four hours, stripped every leaf from the trees. This insect is allied to the *Clisiocampa Americana*, or tent caterpillar, which is described and figured on pages 585–587, figs. 7 and 8, of the Report of the Board for 1875–6. It is what is called

THE FOREST TENT CATERPILLAR.

CLISIOCAMPA DISSTRIA. Hub.

Fig. 5.



CLISIOCAMPA DISSTRIA.

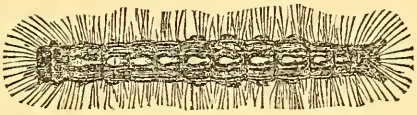
a, cluster of eggs on a twig.
b, female moth.
c, *d*, eggs enlarged.

By comparing the figures above cited with figs. 5 and 6, many of the points of difference will be seen, though there is not a little similarity.

The moth is rather smaller in *C. disstria*, or, as it has heretofore been called, *C. sylvatica*, than in *C. Americana*. The wings expand $1\frac{1}{4}$–$1\frac{3}{4}$ of an inch, and are of a smoky brown color; the front pair are crossed by two reddish, or rust-colored bands, the third pair are of a uniform red-brown. The body is dusky yellow. On the front wings the space between the transverse bands is usually darker than that outside, while in the moth of the common tent cat-

erpillar the corresponding space is lighter. The eggs are deposited on a twig, and form a band about it as in the common tent caterpillar, but in the forest caterpillar the ends are cut squarely off, while in the other they slope gradually, and I think that in this the cluster is rather smaller. The larvæ of *C. disstria* are somewhat smaller. They are very hardy. Riley says that sometimes they hatch before the buds of their food plants are open:—"and though it may freeze severely afterwards, yet these little creatures are wonderfully hardy, and can fast for three whole weeks if need be, and withstand any amount of inclement weather."

Fig. 6.



Larva of Clisiocampa disstria.

As soon as the caterpillars are hatched, which is in early spring, they begin to crawl about and spin a web. They usually live in groups; at this time they are black, covered with light hairs. "In about a fortnight from the time when they begin to feed they change their skin, just before this they are light yellowish brown, rather darker at the ends than in the middle of the body, with the little warts, which give rise to the hairs, quite distinct, and a conspicuous dark interrupted line along each side of the back. After the first moult they are characterized principally by two pale yellowish lines just below the back, bordering what was at first the dark line above mentioned. After the next change of skin, which takes place in about a week after the first, the characteristic pale spots appear on the back, the upper pale line becomes yellow, the lower one white and the space between them bluish; indeed, the characters of the mature larva are from this period apparent. Very soon they undergo a third moult, and after which the colors all seem more distinct and fresh, the head and anal plate have a soft, bluish, velvety appearance, and the hairs seem more dense. After undergoing a fourth moult, without material change in appearance, they acquire their full growth in about six weeks from the time of first feeding." (Riley, Third Report, p. 122). The full grown caterpillar (Fig. 6) is from 1½ inch to 2 inches long of nearly equal size throughout, the last joint being a little smaller. Along the middle of the back is a row of long oval white spots, eleven in all. Behind each of these larger spots is a smaller spot, and all are bordered with black. On each side of each ring is a black tubercle from which come several long black hairs. On the hinder part of each segment, behind the spots, are three somewhat broken, reddish yellow lines edged with black. On each side of the light spots which occupy the back, is a light blue band, below which is a narrow band of black and then a light yellow band, below this a black stripe, next, a broader light yellow band and again a black band. The lower side bears a black spot in the middle of each ring; the general color of the lower side being dark blue. The legs are black and covered with short light hairs. The body is thickly covered with yellowish brown hairs, and sprinkled with black dots. The head is bluish, broad and short. When the larva has completed its growth, it wanders about looking for a suitable place for its cocoon. This is very much like that of the common tent caterpillar. The larva spins a web of silk, but does not

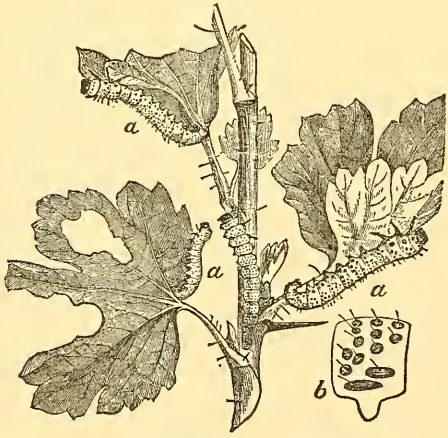
make a conspicuous tent like that of its relative, the common tent caterpillar, but forms only a small web, which is placed close under branches, or against the trunk of a tree, where it is easily overlooked. It may most readily be distinguished from the larva of *C. Americana*, or common tent caterpillar, by the line of light spots along the back, the larva of the latter species having a continuous light line in the same place. It is more commonly known by the name of forest worm. Its food varies considerably, as it eats the leaves of the oak, elm, ash, maple, walnut, wild cherry and other trees, but often when opportunity offers, leaving these for the leaves of the apple. Because they have come from adjoining groves, where they have been feeding unnoticed, they appear very suddenly and in great numbers in apple orchards, and in a few hours they may strip every tree of its leaves, and then migrate to another. A band of wool about the trees is said to be effectual in preventing their ascent. Strong soap-suds, boiled oil, or any oil kills them. In the fall all egg clusters may be removed from the twigs and destroyed. If a tree on which the worms are feeding be jarred, they let themselves down by silken threads, and if the ground beneath the trees is smooth and hard, they may be crushed; and during the last change of skin they often collect low down on the trunk of the trees, and may be crushed in large numbers. There are several parasitic insects that prey upon this. Several large beetles devour these worms whenever they find them. A fly, much like a house-fly, lays its eggs upon the worm when feeding, and the larva hatching from the eggs destroy the worm. Inchneumon flies also attack these larvæ.

THE SAW-FLY OF THE CURRANT,

NEMATUS VENTRICOSUS, King,

described last year, has been exceedingly abundant the present season.

Fig. 7.



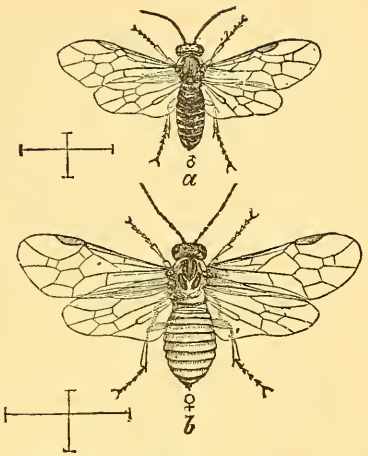
a, *a*, *a*, larva of NEMATUS VENTRICOSUS, (King), in different stages of growth, natural size.
b, portion of joint magnified, showing spots.

In this part of the State this insect in its larval state is the chief enemy of the currant. It has been known in this country during the past twenty years, having been imported from Europe; it has spread over a wide area during this time.

The eggs are laid chiefly on the larger veins of the leaves, although if many eggs are deposited upon a single leaf, the smaller veins are taken after the larger are full, and then the eggs may be placed on the surface of the leaf. The eggs are quite small at first, but increase in size after they are deposited. According to the best authorities, the fly pierces the epi-

dermis of the leaf with its ovipositor so that the egg is brought into connection with the juices of the plant, and by absorbing these it is enlarged. Perhaps the egg is sometimes placed merely upon the surface of the leaf. It is attached by a viscid substance which is deposited with it. All the eggs deposited hatch at the same time. The larva of Nematus, often called "*the* currant worm," very closely resembles that of many moths. It has twenty legs, six true and fourteen false. At first it is of a light color, with a large whitish head. As the skin is changed the color becomes more greenish, and the head grows very dark and finally becomes black and shining, and black spots appear over the body. These spots, or tubercles, are of an oval shape, (Fig. 7, *b*), though varying in size and form, and from each comes usually one, but sometimes more, short, shiny black bristles. These spots tend to arrange themselves in transverse rows. The tubercles on the sides are in two longitudinal rows and are much larger than those on the back. The head is covered with short, black bristles; just above the lateral tubercles is a faint white line, and just behind the head is a collar of yellow and the underside is yellowish; the rest of the body is green, or sometimes bluish green. In full grown larvæ the tubercles bear no bristles. The true legs are black. When full grown, the larva is three fourths of an inch long and quite active. They usually feed in groups, devouring first the pulp of the leaf and small veins. When fully grown the larva goes into the ground and forms a cylindrical chrysalis of a dark brown color covered with particles of earth. It is .35 inch long and .17 inch in diameter and many of them may be glued together in a cluster The pupa is at first of a delicate green shading to yellowish at the ends. The female lays about seventy eggs.

Fig. 8.



NEMATUS VENTRICOSUS. (King.)
a, male, *b*, female.
The lines at the side show the natural size.

The perfect insect is flylike. The male (fig. 8, *a*), is much smaller than the female. It is .23 inch long and .43 inch across the expanded wings. The general color of the upper side is black, or sometimes dark brown, and across the posterior edge of the last five or six joints of the abdomen is a band of yellowish brown, sometimes quite indistinct, sometimes very evident, and the last joint is usually of a light brown, or brownish yellow, and the under side is of a uniform yellow, and this color extends up the sides and is continuous with the light bands above mentioned. The thorax is black above. The head is jet black· The female (fig. 8, *b*), is .32 inch long and .65 inch across the expanded wings. The head and thorax are much as in the male. The abdomen is light yellow, with sometimes a slightly reddish tinge. The legs are very light next the body, but grow darker towards the

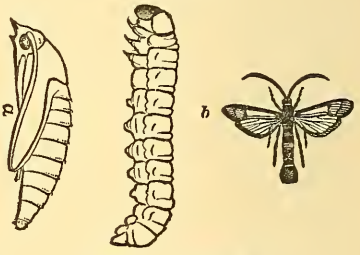
feet. The wings in both sexes are transparent and very brilliantly iridescent with conspicuous glossy black veins, and on the front wings there is a large black spot on the anterior border. This insect appears in this locality at different times, according to the season. The present season is an unusually early one, and the flies appeared by the first of May. Dr. J. H. Worcester gives me the following as the dates when it has appeared in his garden in this city: 1874, June 7; 1875, May 31; 1876, May 26; 1877, May 14; 1878, May 1st. Little more need be said of remedies than was given in the last report; hellebore or hand-picking are either of them efficient.

THE CURRANT BORER.

ÆGERIA TIPULIFORMIS. Linn.

This has not been as common this year as heretofore, but it always is injurious in this part of the State. Its range is very unequal; for, in some parts of Burlington, it is very abundant, while it rarely or never appears in other parts. As the description of this insect given last year was rather brief, a more complete account may be given here, especially as I have nowhere seen any description that mentioned the differences between the male and female, although, as will be seen, such exist. A description of either sex alone is not a full description of the species, although Harris and other authors make no distinction of sex in their descriptions.

Fig. 9.



ÆGERIA TIPULIFORMIS.
a, pupa enlarged.
larva enlarged.
b, moth, natural size.

Figure 9, *b*, shows the perfect moth with its delicate, transparent wings, long, slender legs and graceful form. The upper wings, as shown in the cut, are long, narrow, and widest at the end farthest from the body; the hind wings are more triangular, being shorter and broader than the anterior pair. As these moths are very active in their movements, they are easily mistaken for flies by those not acquainted with entomology. In both sexes the general color of the body and of the upper surface of the large veins of the wings is a very dark blue, or blue-black, with a satin-like gloss, and in a good light the surface is iridescent. Upon this dark ground are various markings of a golden, or sometimes sulphur yellow. The head is dark above, but in front mostly yellow, with a vertical white line on each side, running from between the base of the antenna and eye to the base of the labial palpus. The palpi are dark blue above and yellow below. The forehead is dark brown, or black, covered with punctures, and bears two ocelli. On the thorax, just behind the head, is a collar of yellow, and near the base of the wings on each side is a narrow longitudinal line of the same color. As has been stated, the veins on the upper side are of the general color of the body, but are thickly sprinkled with yellow dots. Across the outer edge of each

wing is an opaque transverse band of steel blue, and below this is a wide band of deep golden yellow, which sometimes becomes orange or copper color. Above and below this band is a dark line. Both pairs of wings are beautifully fringed with fine, silky hairs of a smoky shade. The underside of the wings is more thickly sprinkled with yellow than the upper, so that the yellow predominates over the blue. The legs are dark blue banded with yellow. The abdomen is banded with narrow yellow bands, it is cylindrical, slightly swollen in the middle, and terminates in a tuft of silky hairs. The antennæ are small at the base, many jointed, and gradually increase in size until near the tip, which is suddenly contracted, and turned slightly outward and ends with a small tuft of hairs. As the base of each joint is somewhat narrower than the end of that behind it, the antennæ appear serrate in a good light. They are covered with very fine, sparsely set hairs, which can be seen only when magnified twenty or more diameters. They are blue-black above and yellow below. The *male* varies in size, but is always smaller than the female, sometimes very much so. The smallest male that I have seen measured .25 inch in length and .57 inch across the spread wings; the largest measured .4 inch in length and .74 inch across the wings. In average specimens the antennæ are .2 inch long and on each side bear a closely set fringe of delicate, short hairs, the outer being longer than the inner. These can not be seen without the aid of a lens. The abdomen in the male is more slender than in the female, and the yellow bands encircling it are less distinct and often of a lighter shade. They vary in number in different individuals; in some there are three, in others four, and more rarely a fifth is more or less distinctly seen. In a majority of specimens there are three.

The *female* varies less in size in different specimens than the male, and is, in an average specimen, .4 inch long from head to tip of abdomen, and .76 inch across the spread wings. The antennæ are .2 inch long and are much like those of the male, but are not fringed. The yellow bands of the abdomen are very rarely more than three, though I have seen a rudimentary fourth band on the first segment. These bands are wider and of a deeper color than in the male, and the tuft at the end of the abdomen is usually thicker and larger.

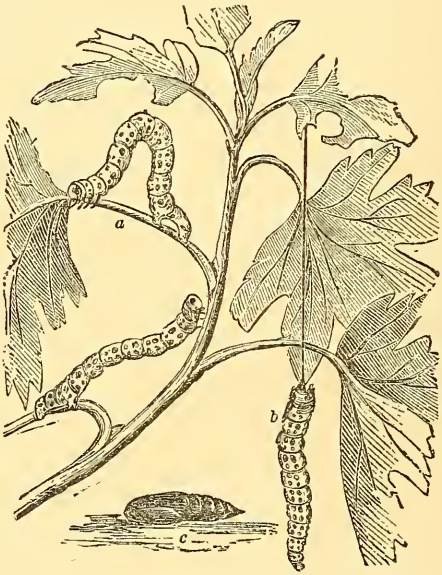
The Ægerias do not appear here usually until the middle of June. Dr. Worcester furnishes me with the following dates of their appearance in his garden: 1871, June 9; 1872, June 14; 1873, June 22; 1874, June 22; 1875, June 15; 1876, June 15; 1877, June 8; 1878, May 31. There is a very interesting fact in the history of the larva of this insect. After its growth is completed and it is about to enter the pupa state, it cuts away the wood between itself and the outside with the strong jaws which it possesses, leaving only a thin skin over the outside, so that when the moth emerges from the chrysalis it has only to push itself through this thin and easily broken skin. Usually, not the moth, but the pupa, forces itself half out of this opening, and remains thus for some hours, at the end of which the moth escapes. Were it not for this preparation of the way it would not be possible for the moth to escape, as neither pupa nor perfect insect have any jaws. No new remedies for this insect have appeared. Infested twigs must be removed and all moths that can be caught destroyed;

but sometimes they destroy the bushes, even if most persistently watched, and all means for the destruction of the pest made use of. Dr. Worcester has covered his bushes with mosquito netting; and if any one wished to take this trouble, and would watch for such Ægeria moths as might come from the bushes after they were protected and destroy them, this means would be effectual. I have seen the small downy woodpecker digging the larvæ of Ægeria, probably from currant bushes, and undoubtedly this bird is able to be of great service in this way.

THE COMMON MEASURING WORM OF THE CURRANT.

EUFITCHIA RIBEARIA. Pack.

Fig. 10.



EUFITCHIA RIBEARIA. Pack.

a, larva full grown.

b, larva spinning a thread of silk.

c, chrysalis.

Eufitchia ribearia, (Pack), was so fully described in last year's Report, that I shall only allude to it here. Fig. 10 shows the larva in different positions. It has not been very common during the past year. It appeared, as did all insects, very early this year, being found

soon after the first of May, though it does not usually appear here until towards the last of that month.

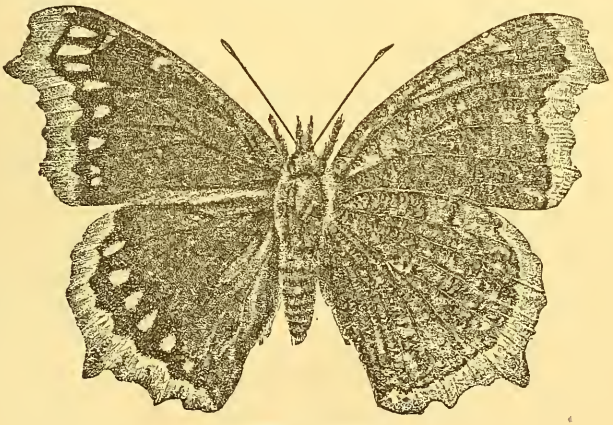
Besides the insects mentioned last year, a species of aphis, which I presume to be *Aphis ribesii*, though I can find no description of that species and hence am unable to identify my specimens, has been abundant on currant leaves. It is of a honey yellow, with white, translucent antennæ and legs. The abdomen is ovoid. They occur in groups on the underside of the leaf and cause the whole leaf to swell and turn reddish purple. If this pest should prove troublesome, the same mode of fumigation which is recommended in the case of *Erythroneura* farther on would be effectual in destroying it. Syringing with whale oil or carbolic soap-suds would be useful, or tobacco tea, though it would be difficult to reach the under surface of the leaves with these remedies. I have also found during the whole season large numbers of the common striped squash-bug on currant bushes, but whether they ate the leaves, or simply lives among them, I could not determine.

A very common and noticeable butterfly in Vermont is

VANESSA ANTIOPA. Linn.

The perfect insect, (fig. 11, natural size,) is a large and elegantly

Fig. 11.



VANESSA ANTIOPA.

colored butterfly. The upper surface of the wings, shown on the left side of the figure, is of a purplish brown color, bordered on the outer edge with a nankeen yellow band, which is almost white in some specimens. Over this band are numerous minute black dots scattered more or less thickly. Inside of this border is a velvety black band nearly a fourth of an inch wide and irregularly scalloped on the edges. On this band is a row of spots, in the cut white, but on the insect of a dark blue. The form and arrangement of these is shown in the figure. The upper margin of the front wings is mottled with black, gray and buff, and bears two dashes of buff, one just touching the black band above mentioned, the other a little inside of this. The

upper border of the hind wings is smoky brown, as is also the lower border next the body. The remainder of the hind wings is colored like the front pair. The lower surface of the wings, shown on the right side of the figure, is very dark, black and dark brown being the main colors, with dashes and spots of buff, white and gray. The buff border of the upper surface is seen on the lower surface also, but it is more abundantly sprinkled with dark dots, so that it is often of an ashen hue. The whole under surface is finely corrugated so that it presents the appearance of crape. The antennæ are slender, simple and thickened at the tip. The spread wings are three inches or more across. This species appears first of all butterflies in the spring and last of all in the fall.

Fig. 12.

Larva of VANESSA ANTIOPA.

The larva (Fig. 12,) is a rough looking caterpillar, nearly two inches long when full grown, black, with numerous small white dots scattered over the body, and along the back a row of eight dark red spots. The head is black and roughened with spines. On each joint except the first, are six or seven long, stiff, branched spines which give to this larva a rather formidable appearance, although it is perfectly harmless. The chrysalis is dark brown, angular, with two rows of spines along the ventral region. It has large, yellowish brown spots on the back. It hangs suspended by a band of silk from stones, boards, &c. It is about one inch long. The larvæ feed on the leaves of various shade trees as elm, willow, poplar, &c. They feed in large companies and sometimes completely cover a tree. Harris says that he has seen branches of elms and willows so loaded with these caterpillars that they bent under their weight. Of course, when existing in such numbers, the damage done would be very great. The butterfly appears here about the 1st of April, its history is as follows: unlike most moths and butterflies, it spends the winter in the perfect state, remaining hidden in crevices and other sheltered places during cold weather in a dormant condition. The eggs are laid soon after it appears in the spring in clusters on the limbs of those trees upon the leaves of which the larvæ feed. They hatch in June, reach their full growth by the last of July, and about the middle of August the perfect insect comes from the chrysalis, and soon the females lay the eggs of a second brood, which develops into perfect insects before winter. With us the larvæ seem to prefer the leaves of the elm to those of other trees. When about to change from larvæ to pupæ, the caterpillars leave the trees and seek a suitable place for the attachment of a fine silk thread in a loop by which they hang themselves, head down. Soon after this is done the neck is bent, and in about twenty-four hours a slit appears in the skin of the back of the head, and through this the head is pushed and the skin moved upwards until it is wholly thrown off. This skin is entirely whole with the exception of the slit above mentioned, and at first it is not easy to see how the larva is able to remove the skin and yet remain suspended. It is accomplished in the following manner: Soon after the slit in the skin of the head

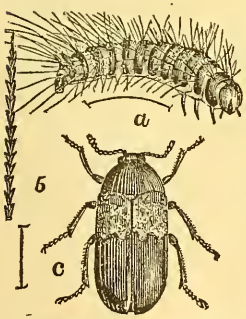
appears, the head is thrust through it. Then follows a series of undulating movements of the body by which means the skin is rapidly thrown upward away from the head towards the suspended posterior part part of the body. When the skin has been pushed within a very short distance, perhaps one eighth inch of the place where the body is attached, the undulating upward motion stops and the posterior portion of the larva is drawn down until it is separated from the skin and extends upward on the outside of the skin, so that at this time the larva is attached to the skin only at the posterior extremity, and the skin is attached to the support. Then, to remove the skin and yet not fall, the larva begins a series of convulsive movements, during which it raises its body till the last segment reaches and clings to the point of the support. It now begins a whirling motion, which soon separates the old skin from the support, and then by a writhing movement the skin is finally separated from the body and falls away. The whole process requires about fifteen minutes. In about two weeks from the formation of the chrysalis the perfect insect comes out. Remedies are not easily applied in the case of such insects as this, which live in large trees, but something may be done to check the mischief which they do, by destroying all that can be captured, and fortunately many of these insects are kept in check by parasites; this is true of Vanessa, which is attacked by at least one parasite, a small hymenopterous insect that lays its eggs on the caterpillars, and these hatch after the former have gone into the pupa-state and devour their host.

BACON-BEETLE, OR LARDER-BEETLE.

Dermestes lardarius Linn.

This is a very generally distributed and troublesome insect. It eats everything of an animal nature; it bores through corks or other barriers to its food. It is an importation from Europe, but has become like so many other imported insects, thoroughly naturalized. The beetle, (Fig. 13, *c*,) is about one-fourth of an inch long, of a dingy black color with a wide band of reddish brown just behind the thorax. The eggs are laid on some substance which can afford food for the larva, where they soon hatch. When fully grown the larva (Fig. 13, *a*) is rather more than a fourth of an inch long, of a russet brown above, but lighter below. It is largest near the head and tapers toward the other end. The body is covered with long barbed hairs, (Fig. 13, *b*.) The beetle is very prolific, and if a number of them once establish themselves they very soon become troublesome. It is chiefly in the larval state that the insect is injurious. It injures ham, dried beef, cheese and such substances, and in collections of stuffed animals it is often a great pest. The beetles and larvæ are easily captured, or where they occur in large numbers they may be destroyed by pouring scalding water or benzine over them. In this connection

Fig. 13.



Dermestes lardarius.
a, larva.
b, one of the hairs of larva magnified.
c, beetle enlarged.

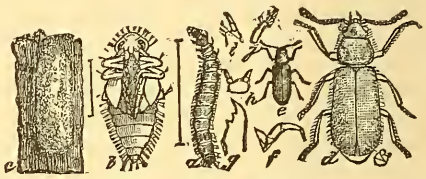
I would call attention to another beetle which is injurous to ham or bacon. This is a smaller beetle than Dermestes, and is known as the

RED-LEGGED HAM BEETLE.

CORYNETES RUFIPES. Fabr.

The larvæ (fig. 14, *a*) are well known to dealers in ham and bacon, and from the cocoon, which is papery, they are sometimes called paper worms. The beetle, (fig. 14, *d* and *e*,) is of a steel-blue color, with reddish legs, and under a lens is seen to be covered with short hairs. Prof. Riley, who has carefully studied the habits of this insect, and from whom the accompanying cut is borrowed, says, after speaking of the eggs, which are laid upon any exposed bit of ham or bacon,—"In a very few days there hatch from the eggs minute white larvæ, with brown heads, a black spot on the first and last joints, and two small hooks or tubercles at the tip of the body. These grow apace, burrowing in the fatty matter next the rind, and especially congregating in the hollow of the bone at the butt end of the ham. With age the larva becomes darker, and when full grown is grayish white, with a series of brown patches superiorly. When about to transform the larva gnaws its way into the more fibrous parts of the meat, or into more solid substances, as wood, etc., and makes for itself a cocoon of a glistening paper-like substance, not spun from a spinneret as with most insects, but disgorged, or spit out, in little globules from the mouth. The insect attacks more particularly such hams as have been injured by overheating in the curing room, or by exposure to sun and rain. It is also attracted by the slime which appears on the outside of such hams as have been left too long to lie in a pile." It always seems to place its eggs not on the ham itself, but on the covering, if there be any, and hence it seeks for cracks in the cloth covering, and if a ham is perfectly covered with canvass it is not subject to the ravages of the beetle, and this precaution would seem sufficient to prevent any serious ravages from the beetle.

Fig. 14.



CORYNETES RUFIPES. (Fabr.)

a, larva; *b*, pupa; *c*, cocoon; *d*, beetle enlarged; *e*, same, natural size; *f*, leg of beetle, *g*, mandible; *h*, labium; *i*, maxilary palpi; *j*, antenna.

An insect which has committed great depredations in this region, as well as elsewhere, is the

PLUM CURCULIO.

Conotrachelus nenuphar, Herbst.

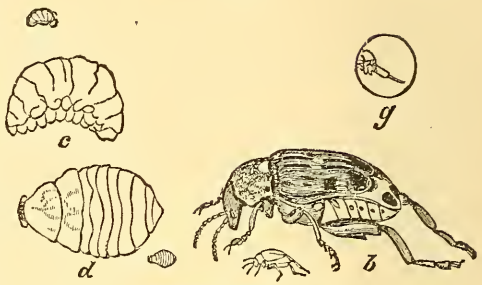
As fruit growers only too well know, this is a very insignificant looking insect. It has been known and its habits discussed more than fifty years, and no very good remedy has ever been discovered. It is too well known to demand extended consideration here, but a few words respecting it may not be valueless. It is one of the small beetles or weevils. The perfect insect is a rough, thick insect of a very dark brown or black color. On the back are spots of white, yellow and black. The wing covers are ridged, and on the back are two very evident elevations or humps, and behind these humps there is a band of yellow. On the lower side of the thighs is a pair of little tooth-like processes. The curculios appear quite early in the season, not far from the first of April, and remain until about the middle of June. As soon as the fruit is set they attack it, the female first cutting a small crescent shaped or semi-circular channel in the fruit, and in this cut she places, usually, one egg, and deposits no more on that plum, but goes from one to another until the supply of eggs is exhausted. The egg soon hatches into a very small white larva with a brown head and no feet. As soon as it hatches it begins to burrow into the plum until it reaches the stone. The injury to the fruit caused by this process is such that gum exudes over the outside of the fruit and finally it drops to the ground prematurely and perishes. As the fruit reaches the ground, the grub, having by this time completed its growth, burrows below the surface. This may occur at any time between the middle of June, and the first, or middle of August. In about three weeks after the larva leaves the fruit, the beetle comes from the ground and lives through the winter. It not only attacks the plum, but also the apple, pear, quince, cherry, peach and probably some other trees. The beetle is sluggish, usually, but sometimes it is active enough and may fly if occasion demands. According to Riley, it occasionally does not go into the ground, but passes the pupa stage in the fruit, and this is usually the case in cherries. A part, Riley says, remain all winter in the ground, coming out in the spring. He also states that the female lays from 50 to 500 eggs, at the rate of from 5 to 10 a day, the number varying with the temperature. "The period of egg depositing extend over two months. The perfect curculio, when in the ground, is soft and of a uniform red color, and in this state it remains an indefinite period, the time dependent upon the weather, usually preferring to issue after a warm rain. In a stiff clay soil a severe drought will kill many of them while in this condition, and larvæ in stone fruits that fall upon naked ploughed ground, where the sun can strike them generally die." The curculio has several insect foes which help to keep it in check. The insect is more active by night than by day. Hundreds, probably, of remedies have been proposed to prevent the mischief which this insect is sure to do if left to itself, but most of them have proved worthless. None seem better than, if as good as, the old method of jarring the beetles from the trees upon sheets spread on the ground beneath.

Another weevil somewhat resembling the plum curculio is that commonly known as

THE PEA BUG.

BRUCHUS PISI. Linn.

Fig. 15.



BRUCHUS PISI. (Linn.)

b, beetle enlarged, (lower figure natural size).
c, larva enlarged, (upper figure natural size).
d, pupa enlarged.

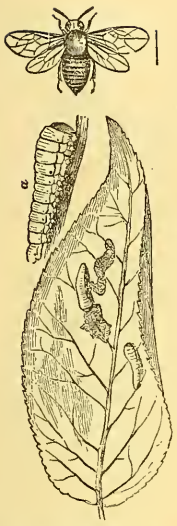
This beetle (Fig. 15, *b*) is a little oval insect, about one tenth inch long, dingy black, with a white spot on the back of the thorax, and four or five white spots on the back part of the wing covers, and on the abdomen, as the end projects beyond the wing covers, is a white ⊤ shaped mark. The beetle lays its eggs, which are of a deep yellow color, about .03 inch long and very narrow, upon the pod, and they are attached to it by a fluid which is deposited with the egg and which becomes white as it dries. They do not seem to be deposited on any particular part of the pod, but anywhere. When these eggs hatch, which they do while the peas are quite small, the larvæ bore their way through the pod, and each locates itself in a pea. At this time the larvæ are small, yellow worms with black heads. The hole by which the larva enters the pea soon nearly closes. The larva feeds and grows, burrowing in the pea and usually avoids the embryo, for which reason peas infested will often grow. When fully grown the larva is a thick, short, yellowish grub .15 to .17 inch long, and half as thick. As it is about to become a pupa, it eats a hole on one side of the pea leaving only the skin untouched. After eating this hole it draws itself back into the pea and "lines its cell with a thin and smooth layer of paste, pushing aside and entirely excluding all excrement." In this cell it passes the pupa state, and comes forth as a perfect beetle, having only to make its way through the thin skin covering the hole. Usually the peas are gathered with this beetle still hidden in them, though if the season should be unusually long or warm, many will come out, but as a rule most remain in the peas through the winter and come out at planting time, and at this time the peas should be examined and all containing the weevil be placed in scalding water, or even warm water, when the beetles, most of them, will rise to the top and may be removed. The custom which some pea-growers follow, of keeping peas over one season before planting is a very good one. Late peas are less likely to be infested than early ones.

Another disagreeable and sometimes very troublesome insect is the

PEAR SLUG.

SELANDRIA CERASI. Peck.

Fig. 16.



SELANDRIA CERASI. (Peck.)
a, larva enlarged.
b, perfect insect.

The eggs of this insect are laid on the leaves in semicircular incisions, usually but not always on the lower side, and in two or three weeks the deposition of the eggs is completed. They hatch in a couple of weeks into white larvæ, or slugs, which soon become slimy and of a greenish color, Fig. 16, *a*. They have six true and fourteen false legs; are rather less than one half inch long, the head is brown, and from the first joint the body tapers towards the last. They eat the green parts of the leaf. According to Harris, when the skin is last shed the slimy coat is lost, and the larva is covered with "a clean yellow skin." In a few hours after the last change of skin they creep, or fall to the ground, into which they burrow two to four inches, and then each larva moves round and round until it has formed a smooth, oblong cell, which is covered inside with smooth varnish. In these cells the insects remain sixteen days, and in July or August come forth as perfect flies, which soon lay a second brood of eggs, which hatch and complete the larva state before fall, when they go into the ground and remain there as pupæ during the winter, coming out as flies the next spring. Harris says, however, that all the brood do not come from the chrysalis at the same time, but remain over one year and come forth the following spring. The perfect insect (Fig. 16, *b*,) is a transparent, glossy winged fly, nearly a fourth of an inch long in the female, less in the male. The body is black and the first two pairs of legs are dingy yellow, with black thighs. The wings, as is usually the case with saw-flies, are crumpled and iridescent and have a smoky tinge.

According to Mr. Saunders some varieties of pears are exempt from the attacks of the insect, others are only slightly injured, while others are greatly injured. The best remedy is one which he has tried, and which is substantially as follows: "A raised platform was rigged up on a one-horse cart, in which was placed a barrel of water in which a pound of hellebore had been mixed, and from the elevated stand this mixture was showered on the trees from a watering pot. It was astonishing to see how quickly the trees were cleaned; scarcely one was found on a tree the morning after the application was made.

The remainder of this paper I shall occupy with an account of the principal

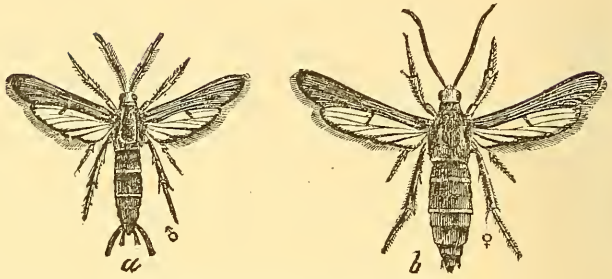
INSECTS INJURIOUS TO THE GRAPE,

found in Vermont. Attacking the roots of grape vines we have a moth—an Ægeria—much like the currant borer, but much larger. It is not common with us, and has never committed such ravages as it has in the Western and Southern States. It is the

GRAPE ROOT BORER.

ÆGERIA POLISTIFORMIS. Harris.

Fig. 17.

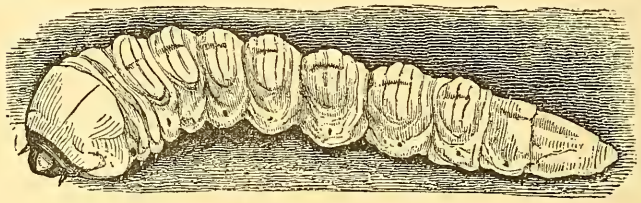


ÆGERIA POLISTIFORMIS. (Harris.)
a, male. *b*, female.

The larvæ live in the roots of grape vines, burrowing extensively, and of course injuring, or destroying them. The general appearance of this moth is seen in Fig. 17, *a*, male, *b*, female. As the figure shows, the female is much larger than the male and differs from him in many respects. From the character of its attacks this insect is very difficult to deal with, and it is to be hoped that it will never be abundant with us.

PRIONUS LATICOLLIS. Drury.

Fig. 18.

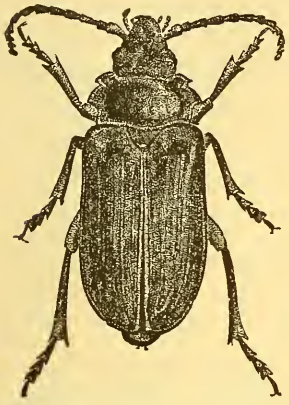


Larva of PRIONUS LATICOLLIS, (Drury,) natural size.

This is, in the larval state, a borer, and sometimes does much mischief to grape roots. The larva, (Fig. 18,) is a very large, white, or light yellow worm, with a dark brown head and black jaws. It is translucent along the back and in some other parts of the body. The length is three inches. The legs are quite imperfectly developed, the false legs being mere tubercles. The body is, as the cut shows, widest at the first joint and tapers backward from there to the last. The body also becomes thinner, as well as narrower, towards the posterior end. The upper side of each segment is flattened. The larva lives under ground, burrowing in the roots of the apple, pear, grape and other trees, and even in dead wood, as I had a specimen brought

me last summer which had excavated a long gallery in a two inch spruce plank that formed part of a cistern wall and was several feet below the surface. In this it was living and apparently thriving. In the west and south this insect has done considerable damage to grape vines. Its great size, though enabling it to do much mischief in a short time, also makes it easy to find it and destroy it. It sometimes bites off a vine near the surface and then burrows down in the main root. In course of time, Riley thinks three years, the larva becomes a pupa. The pupa state is passed in the earth in confinement, but Prof. Riley thinks that it naturally transforms in the root, and in about three weeks the perfect beetle, (Fig. 19, female,) comes forth. It is of the form shown in the cut. The color is a dark chestnut brown. It is about $1\frac{3}{4}$ inches long and .65 inch broad. In his second report, Prof. Riley has described another species of Prionus, *P. imbricornis*, (Linn), which resembles that figured and which, in the larval state bores into grape roots. As I do not know that this species is found in Vermont, I do not give space to a full account of it. By far the largest number of insects that injure the grape attack the leaves. Many moths belong to this class. First we may mention

Fig. 19.

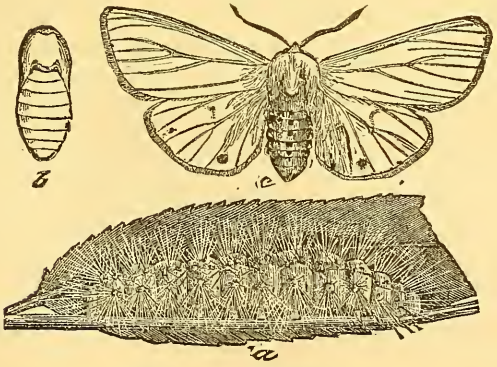


Prionus laticollis. (Drury.)

YELLOW BEAR CATERPILLAR.

Spilocoma virginica. Fabr.

Fig. 20.



Spilocoma virginica.

a, larva; *b*, pupa; *c*, moth.

This is a very common moth, of a pure white color on the wings, with a black dot on the center of the front wings and two, sometimes

more, on the hind wings. The thorax is clothed with long, hairlike scales, the abdomen is bright orange, with a row of black spots along the middle of the back and along each side. The wings expand 1½–2 inches. The antennæ are simple jointed rods. The general form may be seen in fig. 20, *c*.

The larva, or caterpillar, (fig. 20, *a*,) is often seen—a rough hairy worm of a yellow, or yellowish brown color, variegated in different specimens. Along each side is a black line and a less conspicuous line of the same color between each two joints. The under side of the body is always dark, but the ends of the feet are light yellow as is the head. The length is about two inches. They occur all summer—from June till the last of September or October. It is a general nuisance, as it feeds on almost all kinds of vegetable or flowering plants and greedily devours grape leaves. The eggs are laid on the leaves in clusters and the caterpillar is most often seen on the under side. It is easily seen, and may be kept in check by hand-picking. It is also kept in check by numerous parasites.

Another caterpillar found devouring the leaves of grape vines is

AMPHYPYRA PYRAMIDOIDES. Guen.

Fig. 21.

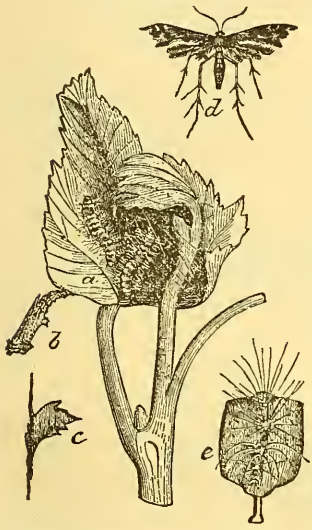
AMPHIPYRA PYRAMADOIDES. (Guen.)

The moth (fig. 21) is about the size of the foregoing, but of quite different appearance. The front wings are of a brown color, with spots and markings of purple, gray, yellowish and white. The hind wings are of a coppery hue. The under surface is lighter than the upper. The lower edge of the hind wings is slightly scalloped, and finely fringed. The body is yellowish brown on the thorax and darker on the abdomen. The wings expand 1¾ inches. The larva is 1½ inches long, largest behind. The general color of the body is light green, or bluish green on the sides. There is a light line along the middle of the back and a narrow yellow line along each side of the back. Along each side of the body is a bright yellow line which is interrupted by the breathing holes, at which points it becomes white. The last joint is much higher than the rest, and the elevated upper surface forms a sort of pyramidal prominence which slopes rapidly downward behind. This species has not appeared in the East in any considerable numbers but it is occasionally found. A little yellow caterpillar about three fourths of an inch long is, in many places, injurious to grape vines. This is the larva of a delicate moth—

PTEROPHORUS PERISCELIDACTYLUS. Fitch.

The perfect insect is a little moth with narrow wings, which when spread, are less than an inch across. The thorax is yellowish brown; the abdomen is dark and becomes black at the end. On each of the first three joints there is a white spot, and on the third two white lines; the fourth joint is dark without lines or spots while the rest have two parallel light lines. The under side of the abdomen is white with two yellow stripes. The legs are striped with white and brownish yellow. Like other species of the family to which it belongs, this moth owes much of its beauty to the division of the wings into several parts. The front wings are divided into two parts about half of their length, and the hind wings are divided into three parts, each division being beautifully fringed, so that the entire wing is an exceedingly elegant and beautiful object. The general color of the front wings is dark brown marked with white, while the hind wings are like burnished copper. The legs, as the cut (Fig. 22) shows, are long and slender and the moth is very quick in its movements. The larvæ, (Fig. 22, *a*,) are, when mature, about one half inch long, pale green, with fourteen rings. Along the back are two rows of white spots, and one row along each side, and between these spots are smaller white spots. All of these are raised above the general surface, and from them come bunches of hairs or bristles, in all four rows above the breathing holes and six below them. and some of these clusters of hairs are shown in fig. 22, *e*. The head is yellow, as are the legs. The worms devour the leaves of the grape and by fastening the edges of the leaves together in a more or less globular form, they make a sort of hiding place in which they spend most of the day. They feed for about three weeks and then form chrysalids, which are usually of a dark color, irregular, covered with projections and prominences so that each one looks like a bit of broken twig, Fig. 22, *b*. These are not uniform in color, and we find here an interesting example of mimicry to which Prof. Riley has called attention. Alluding to the fact that the chrysalids vary in color from light green to darker green, he quotes from Mr. M. C. Read, of Hudson, Ohio, as follows: "Of a large number raised in jars by me, there were two well defined colors, one a reddish brown resembling closely the bark of ripe grape wood, the other a light green, or exactly the color of the leaves and young wood. Without an exception the green ones were attached to green leaves and green wood, or to the glass of the jar of a similar color; while all the brown ones were attached to

Fig. 22.



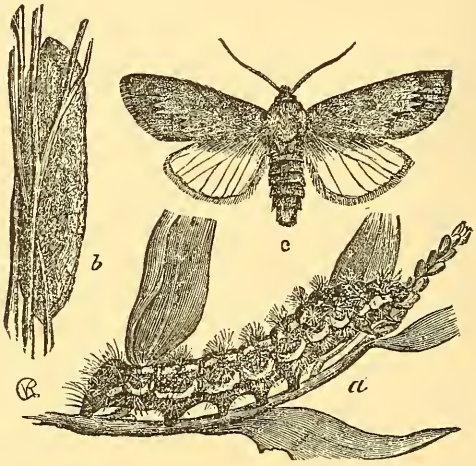
PTEROPHORUS PERISCELIDACTYLUS.
a, larva feeding.
b, pupa.
c, one of the horns of pupa enlarged.
d, moth, natural size.
e, part of a joint of larva enlarged.

the stems of ripened wood." Riley says that his own observations accord with those just quoted, and because of this mode of concealment there may be large numbers in a vineyard and yet all escape observation. As a remedy against this moth, hand-picking would seem to be sufficient, and is the less difficult from the habit referred to of rolling up the leaves and thus making its presence known.

A rather common moth, described in the last Report as one of the insects attacking the Strawberry, is also injurious to the grape. This moth,

ACRONYCTA OBLINITA, Sm.,

Fig 23.



ACRONYCTA OBLINITA. Sm.

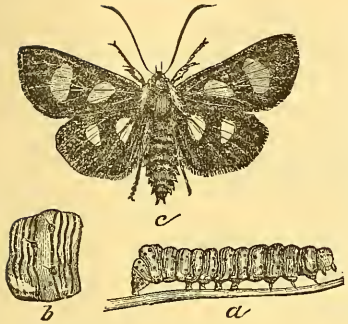
a, larva; *b*, cocoon; *c*, moth.

does not often do very great damage to the grape, and is easily seen and can be picked off. It has several insect foes that diminish its numbers. The caterpillar (Fig. 23, *a*) is of a dark color, black along the back with two rows of bright yellow spots, and along each side a yellow band. Numerous light dots are sprinkled over the body, and on each segment is a row of tubercles, which bear tufts of bristly hairs reddish on the back, yellowish on the sides. The surface is velvety and the general appearance attractive. The moth (Fig. 23, *c*,) is less handsome. The front wings are gray, with a few black dots, and the hind wings are white. The cocoon (Fig. 23, *b*) is white or yellowish. The larva is quite a general feeder, eating leaves of several kinds of trees and plants.

A very common moth in some parts of the West, though less common in New England, is

ALYPIA OCTOMACULATA. Fabr.

Fig. 24.



a, larva.
b, joint of larva magnified.
c, moth, natural size.

The moth (Fig. 24, *c*) is very easily recognized by the two light spots on each wing. The general color of the wings is very dark, and on each of the front wings are two large yellow spots and on the hind wings white, as seen in the engraving; they are 1½ inches across when spread. The moths appear early in June. The larva (Fig. 24, *a*) is a whitish worm with eight black transverse lines on each joint, four on each side of a median band, which is broad and of a reddish yellow color; each joint also bears black spots. These characters are shown in Fig. 24, *b*. It is 1½ inches or less in length, and eats the leaves of grape vines. A much more common moth with us and one of the most elegantly marked species that we have is the

BEAUTIFUL WOOD NYMPH.

EUDRYAS GRATA. Fabr.

This moth is very striking in its appearance. The front wings are pure white, with the outer border bordered by a wide maroon band edged with a white line and on the inside is a line of olive green. Near the body are long spots of maroon, the position being shown in the engraving. The hind wings are deep yellow with a purplish brown band below. The under surface of both pairs of wings is yellow with two black spots on each front wing and one on each hind wing. The thorax is white with a black band through the center. The abdomen is yellow with black spots. The head is black. The wings, when spread, are 1½–1¾ inches across. The moth does not make its appearance until midsummer. The larva feeds upon the grape, hop and woodbine. It is 1½ inches long, of a bluish color with six black, transverse lines on each joint and a number of dark hairy spots. The head is yellow, spotted with black.

Fig. 25.

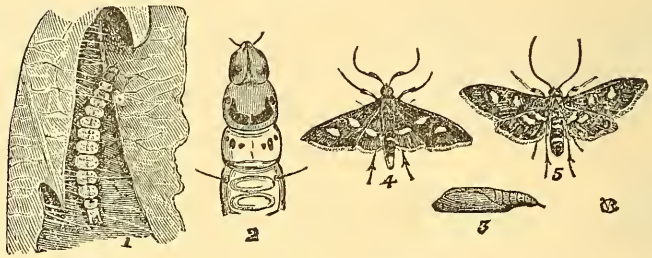
ENDRYAS GRATA. Fabr.

Another similar, though less showily colored species, *Eudryas unio*, *Hub*, is very much like the preceding in the larval state, and is said to feed upon the grape. There is one of the leaf-rollers which attacks the grape, a very pretty little moth about an inch across the spread wings. This is

DESMIA MACULALIS. West.

The wings are black, with two large oval white spots on each front

Fig. 26.



DESMIA MACULALIS. West.
1, larva in leaf; 2, anterior part of larva enlarged; 3, chrysalis; 4, male moth; 5, female moth.

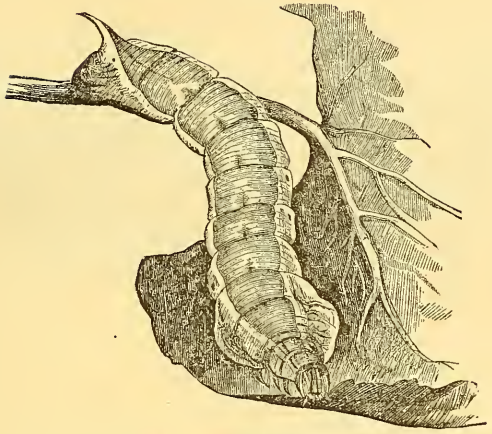
wing, and in the female on each hind wing, but the male has usually but one on each hind wing. The female has two white bands across the abdomen. The body is black. The larva folds together the edges of leaves of the grape and fastens them with silken threads. (fig. 26, 1.) It is an active, green worm, and sometimes proves very destructive. The chrysalis is made of the folded part of the leaf, and may be picked off and destroyed in the fall before the leaves drop. As in the case of all the leaf-rollers, the presence of the larva is made evident by the crumpled leaves, and these should, whenever seen, be removed, but as most of these larvæ are active, some care must be taken lest they escape. Riley says that a species of beetle, *Colaspis flavida*, to be mentioned hereafter, is almost always found with this leaf-roller or, as he more aptly calls it, leaf-folder, and that it lives in the retreat formed by it. "On finding it so invariably in this fold, I at first supposed that it merely took advantage of the position for shelter, little suspecting that it would feed upon the worm, since the family to which it belongs is essentially herbivorous, and the leaf-folder is so very active; but from having found numbers of the shrunken and half-dead worms, I was led to conjecture that it does actually prey upon them." (Third Report, p. 82.) As Desmia is a southern insect it is not likely to occur in Vermont in large numbers.

A large moth, which is very common in some parts of the country, in vineyards, occurs in Vermont, though not in great abundance. This is what is known as

CHAEROCAMPA PAMPINATRIX. S. and A.

The larva (Fig. 27) is a large worm of a pea-green color. The head, first and second joints are very small, but the third and fourth are much enlarged, especially in width. The remaining joints are of almost equal size. The body is covered with light yellow dots. Along each side is a light line, and along each side of the back is a similar light line which runs up into the horn-like prominence of the last joint. Along the back are five or six light triangular spots, in

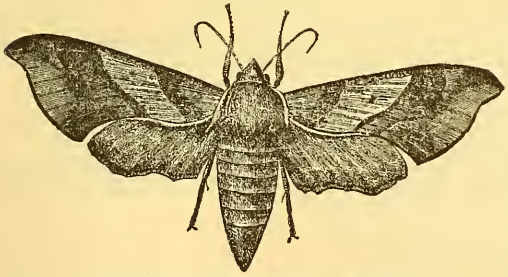
Fig. 27.



Larva of *Chaerocampa pampinatrix*, (S. and A.). natural size.

each of which is a smaller lilac spot, as shown in the figure. The breathing holes are reddish brown. Riley says of this worm, that when about to transform it "changes to a pinkish brown, the darker parts being of a beautiful mixture of crimson and brown." It feeds upon the grape leaves until ready to become a pupa, when it goes to the ground, but does not burrow below the surface. The moth (Fig. 28) is 2½ to 3 inches across the wings. The thorax is olive green, the abdomen the same color, but more yellowish. The front wings are gray, with a little reddish tinge, and across the ends a broad, somewhat broken band of olive green and another next the body. The hind wings are deep reddish brown. The larva eats voraciously and is able to inflict much damage upon grape vines if allowed to remain long. It is easily kept in check by hand-picking, and is attacked by ichneumon flies, as I have already mentioned in the first part of this paper, and Fig. 1 shows a larva of this moth bearing cocoons of one of these parasites. A much larger, and, fortunately, rarer moth, also attacks the leaves of the grape vine. This is known as

Fig. 28.



Chaerocampa pampinatrix. (S. and A.)

PHILAMPELUS ACHEMON. Drury.

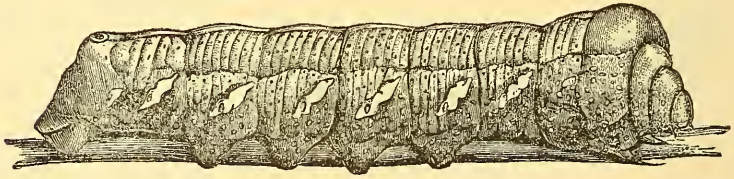
This is a very beautiful moth and like the preceding one of the hawk moths, or *Sphlinges*. It is three or four inches across the expanded wings.

Fig. 29.

PHILAMPELUS ACHEMON. Drury.

The front wings are dark ashen, shading into lighter gray, with dark brown or nearly black spots, and dark, irregular, transverse lines. The hind wings are rose-pink next the body; beyond this is a dark band, and the outer edge is gray. The head and thorax are about the color of the front wings; the latter with a triangular dark patch on each side. The arrangement of these colors is well shown in the engraving (Fig. 29). The larva (fig. 30) is a large, clumsy worm,

Fig. 30.



Larva of PHILAMPELUS, natural size.

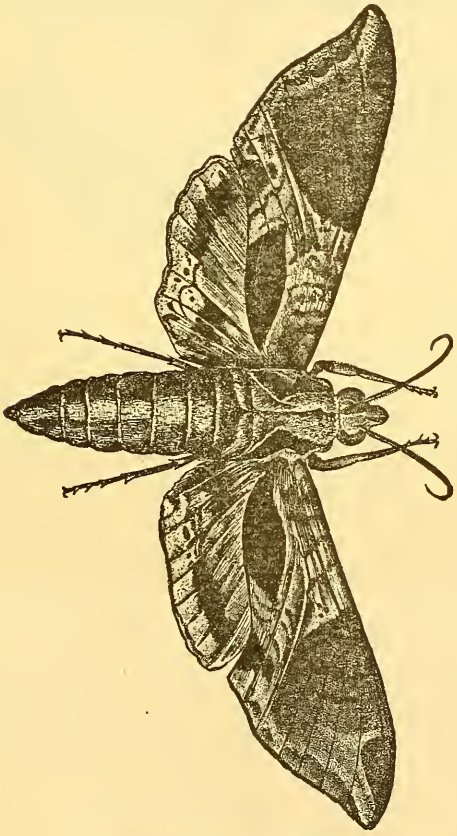
three inches or more long when mature. It is of a light green color, usually, though it is sometimes brown. Along each side is a light yellow line, and below this six or seven long, oval, cream-colored spots, placed obliquely, one on each side of each ring. The whole surface of the body is more or less dotted with dark green spots as it occurs here. Riley says that when about to pupate the color "is often of a most beautiful pink or crimson." In the young larva there is, on top of the last joint, a long horn which curves over the back but, as the larva grows older and changes its skin, this horn is lost, and at last its position is marked only by a polished tubercle, of a yellow color with a black center. The head and first two joints can

be drawn into the third, which is much larger than the rest. So large a larva is able to devour great quantities of grape leaves, but it is also easily seen and picked off. It feeds upon the leaves of the Virginia creeper as well as upon those of the grape. When mature, which with us is about the last of August, the larva enters the ground and remains there in the chrysalis until the following summer, the moths appearing about the first of July. A closely allied species somewhat larger than the preceding and quite rare in this region is

PHILAMPELUS SATELLITIA. Linn.

This also lives on the leaves of the grape vine and Virginia creeper. The moth (fig. 31) is four or five inches across the expanded wings; its

Fig. 31.



Philampelus satellitia. Linn.

general color is grayish like that of *P. achemon* with similar dark blotches, spots and lines, the position and forms of which are shown

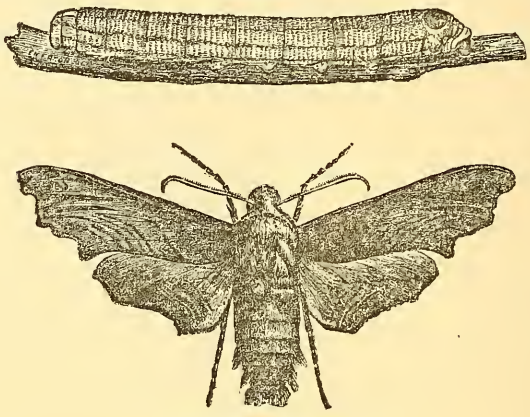
well in the engraving. It is lighter than the foregoing species and the hind wings are not pink, but are colored like the front wings. The larva is, when fully grown, four inches long; of a dark, reddish-brown color, with five broadly oval yellow spots along each side, and above them a light yellow line.

The last moth which I shall mention as injurious to the grape is a smaller species than those just described though still a large moth. This is what it is called

ABBOT'S SPHINX.

THYREUS ABBOTII. Swain.

Fig. 32.



THYREUS ABBOTII. Swain.
Larva and moth natural size.

The wings of this moth (Fig. 32) are somewhat scalloped at the ends, $2\frac{1}{2}$ to $2\frac{3}{4}$ inches across when spread, the front pair of a grayish brown, lighter near the middle, marked with lines and streaks of a darker color. The hind wings are light yellow, with a wide border of dark brown. The body is compressed and tufted at the end. The larva (Fig. 32) varies considerably in appearance, being sometimes reddish brown with patches of light green, an interrupted dark brown line along the back, and five transverse lines. Other specimens are dirty yellow, without any green. In all the head is dark colored. It is not at all common here.

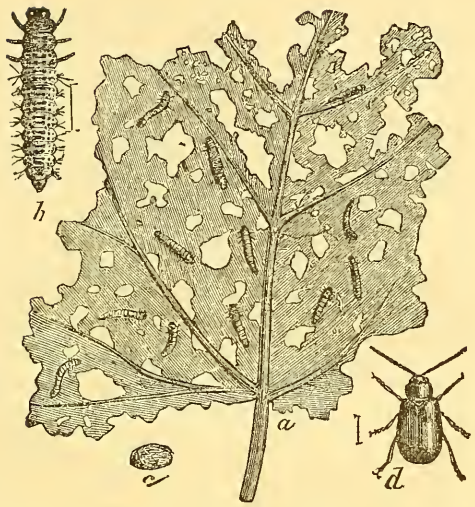
Among the beetles there are several that seriously damage grape vines by eating the leaves. One of the worst pests that the grape grower meets with in this State is a little flea-beetle, which sometimes occurs in very great numbers, completely riddling the leaves. This is the

GRAPE-VINE FLEA-BEETLE.

HALTICA CHALYBEA. Ill.

The perfect insect (fig. 33 *d*) is too familiar to require much description. Its color varies greatly, as Harris well remarks, "specimens being often seen on the same vine of a dark purple, violet, Prussian

Fig. 33.



HALTICA CHALYBEA. Illiger.
a, leaf with larvæ feeding; *b*, larva enlarged; *c*, pupa cell; *d*, beetle enlarged.

blue, greenish blue, and deep green color." The upper and under sides usually differ in color, the former being most often greenish blue and the latter dark green. The beetles are about three twentieths of an inch long and a little more than half as wide. They appear early in the spring and attack the buds as soon as they begin to swell and may injure them so seriously as to prevent their development and always damage them so much that the leaves are small and weak. After the leaves unfold the beetles may wholly disappear, but presently—in June or the latter part of May—the larvæ (fig. 33, *a*, *b*,) will be found eating the leaves. They continue their devastations through most of June. When mature they leave the vine and go into the ground and change into chrysalids, without any cocoon, but form a cell (fig. 33, *c*,) in which they transform, and appear as perfect beetles about the middle of July. They pair about the first of May, and the females lay their eggs, which are ellipsoidal, of a sulphur yellow color, about one-twentieth of an inch long, on the buds and joints and in crevices of the bark, where they hatch in about three weeks into dusky yellow larvæ one sixteenth of an inch long, which during the next month grow until they are about one-third of an inch long and nearly black. The head is shining black and behind it are eleven rings. On each ring are two rows of black glossy spots, twelve in each row, and from each spot comes a short hair. The chrysalids are about one sixth of an inch long, of a dull yellow, covered with black bristles arranged in transverse rows, one row on each joint. As remedies a great many substances have been proposed. The small size of both larvæ and beetles makes hand-picking very difficult. The beetles spend the winter under chips or stones

or any such shelter, and if, in September or October, bits of board, large chips and the like be placed about the vines many of the beetles will, on the approach of cold weather, take refuge under them, and as they become torpid as the weather becomes cold, they may be caught and destroyed. Dry lime blown over the leaves, or hellebore water sprinkled over them would probably be efficacious. Whale oil or carbolic soap suds would also be useful.

Another somewhat larger and more scarce insect, which was mentioned in the last Report as sometimes injuring strawberries, is chiefly mischievous to grape vines. This is

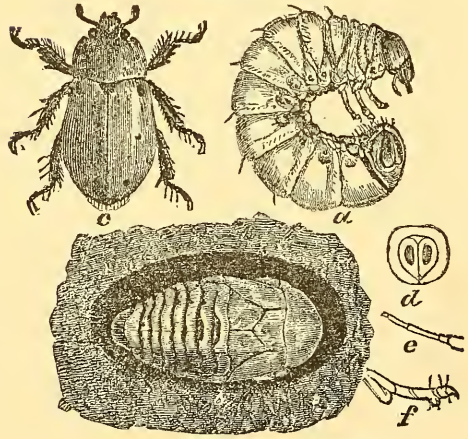
COLASPIS FLAVIDA. Say.

It is about one fifth of an inch long, of a light yellow color. The larva as described by Riley is of a dingy yellow color and is covered sparsely with stiff yellowish hairs. The head is yellow. It is about one fourth of an inch long. This beetle is not, so far as I know, common in Vermont, but in New York it has done great damage to the vines and there seems to be no reason why it should not appear here at any time in sufficient numbers to do great harm. It seems that in the larval state it devours the leaves of the strawberry and from them goes to any grape vines that may be near at hand.

There is a large beetle of much the shape of the common May-bug which sometimes eats the leaves of grape vines. This is

PELIDNOTA PUNCTATA. Linn.

Fig. 34.



PELIDNOTA PUNCTATA. (Linn.)
a larva full grown.
b pupa. *c* beetle.
d posterior end of larva.
e antenna. *f* leg of larva.

It is light grayish-yellow or clay color with sometimes a greenish tinge. On each wing cover are three very distinct black dots. The thorax is darker than the wing covers and has one black spot on each side. The legs and under side of the body are dark bronze-yellow. The size and form are shown in the cut. The larva (fig. 34. *b*) is a large white grub, with shining brown head and of the form and size shown in the figure. It lives in decayed wood. The beetles are found in July and August. They fly usually by day.

One of the rose beetles is sometimes very troublesome in vineyards. This is

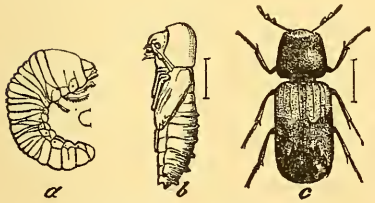
MACRODACTYLUS SUBSPINOSUS. Fabr.

It is a small beetle about one fourth of an inch long, of yellowish color, which is due, however, to a thick coat of grayish yellow down. The legs are slender and of a dark red color. According to Harris, of whose account the following is an abstract, the female lays about thirty eggs, which she deposits from one to four inches below the surface of the ground. They are nearly globular, whitish, about one thirtieth of an inch in diameter, and hatch in about twenty days after they are laid. The young larvæ feed on such tender roots as are within their reach. They reach their full size in the autumn, at which time they are nearly three fourths of an inch long. They are yellowish white with a tinge of blue towards the posterior end, which is thick and obtuse or rounded. A few short hairs are scattered over the body. In October they descend below the reach of frost and pass the winter in a torpid state. In the spring they approach the surface, and each forms a little oval cell by turning around and around so as to compress the earth and form a hard cavity. In the cell thus formed the larva passes the pupa state, and in June of the following year the perfect beetle comes out and lives for thirty or forty days, and then, having laid the eggs dies. From this account of the larval life of this beetle it is evident that at this time they are largely out of the reach of man and must be attacked mainly in the perfect state, when they can be found on the vines and brushed into a dish of scalding water, kerosene, or any destructive liquid, or picked off and burned. The beetle attacks rose bushes and sometimes apple trees, as well as grape vines. According to some writers this insect prefers the Clinton grape to any other, and on this account, if in a collection of vines there should be now and then a Clinton, the insects would collect on these and might be the more easily destroyed.

Another beetle injurious to grape vines is

SINOXYLON BASILARE. Say.

Fig. 35.



SINOXYLON BASILARE. Say.
a, larva; *b*, pupa; *c*, beetle, all enlarged.

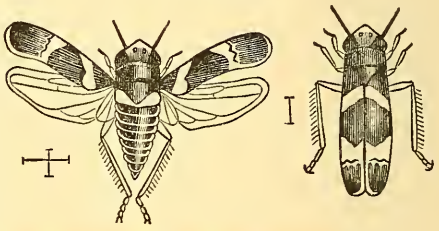
It is not very common in this State, but wherever it occurs, even in small numbers, it is very mischievous. The larva bores into the shellbark walnut, apple, peach, and perhaps some other trees. The beetle is about one fifth of an inch long, black, with a large red spot on the base of each wing cover, whence it is called red shouldered sinoxylon. The upper surface is covered with punctures. The general form may be seen from the cut. The larva (Fig. 35, *a*) is a yellowish grub with six bristly legs, a small head of a light horn color with black jaws. It is about one fifth of an inch long. As is true with all borers, this is a difficult insect to find when it is at work doing its mischief, and the only way to exterminate it would be to cut off and burn all infested twigs; but it is not possible always to know which are the infested twigs until too late.

One of the most troublesome insects to vine growers in this region is a little Hemipterous insect which often occurs in immense numbers, devouring and destroying the leaves. This is the

ERYTHRONEURA VITIS. Harris.

It is only about one tenth of an inch long. The color varies; some are pale yellow with faint markings, in others the wing covers are barred with broad scarlet bands, while the tips are black; the thorax is scarlet behind, the wings are yellow, the body light brown. The insects appear here about the first of June, or sometimes not until the middle of June, as larvæ. These are not unlike the perfect insect, but they do not reach maturity until the middle of August. They are furnished with sucking mouths by means of which, having thrust the beak into the leaf, they suck up its juices. They leap very briskly if disturbed. As they grow the skin is cast off to make place for a new one, and these thrown-off skins may be seen in large numbers scattered over an infested leaf. They are white or whitish. The adults are very lively little creatures, leaping or flying with great agility. At first they eat only the epidermis of the leaf, but they eat deeper and deeper into its tissues, until it is riddled with small holes and turns whitish or brownish, and ultimately destroyed, and in this way every leaf on a vine may be ruined. In the fall the Enythroneura leaves the vines to conceal itself under fallen leaves, sticks, stones, or any rubbish which may be about the vines.

Fig. 36.



ERYTHRONEURA VITIS, Harris, enlarged.

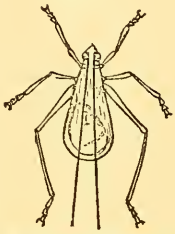
In the spring it comes from its hiding place, lays its eggs and dies. It is not an easily controlled insect by any of the ordinary methods if it has once become abundant. Various washes, as lye water, soap suds, tobacco water, etc. have been recommended and are undoubtedly useful, but I think the most satisfactory remedy where it can be applied is that which Harris advises, viz: fumigation, and this if well done would destroy all insects that would be likely to be on the vines. The best mode of fumigating vines is to make a tent of coarse cloth and cover the infested vine with it as completely as possible. Then take a mass of tobacco stems—experience will soon teach how large a mass; it of course will vary with the size of the space to be filled with smoke—and, having dampened them thoroughly by a moment or two of immersion in water or a little sprinkling, put them in a dish of live coals, and the whole under the covering. If coals are not at hand a handful of shavings will do very well in their place. In this way the vine may be enveloped in a dense smoke, and it should be left in this condition for several hours. If done in the evening the covers may remain until the next morning. If convenient to do so it is very well to give the leaves a good showering after the fumigation is completed. The *Erythroneura* is sometimes attacked by a

parasite, as Dr. Worcester has found one into which a small insect had thrust its proboscis. This latter was unfortunately crushed in preparing it for the microscope and could not be identified.

THE TREE CRICKET,

Œcanthus niveus, Say.

Fig. 37.



ŒCANTHUS NIVEUS. (Say)

mentioned in the last Report as injurious to the Raspberry, is also injurious to the grape. The general color of the insect (fig. 37) is light greenish with gauzy wings. The female deposits her eggs on the twigs of the vine and also on the canes of raspberry, blackberry, peach, willow, etc., making a hole for each, and thus quite a row of holes is formed, one beneath the other. The twigs thus pierced die. The *Œcanthus niveus* seems to damage the grape more than it does anything else, and besides puncturing the vine it also cuts the stems of grapes or of whole bunches so that they fall off. Should this insect become very numerous it would be no easy task to keep it in check, but, fortunately, it has not hitherto been very abundant. The only remedy apparent is the cutting off and destroying all infested twigs. Grape growers in Vermont have not so many enemies to contend with as in more southern localities. The greatest of all troubles to grape growers in Europe and the West, the Phylloxera, has not yet made its appearance in Vermont, and many of the species described in the foregoing pages are far more abundant and destructive in other localities than with us. The *Haltica chalybea* and *Erythroneura vitis* are most troublesome here.